Annals of Clinical and Analytical Medicine
Original Research

Reliability of percutaneous suprapubic cystostomy catheter insertion and analysis of complications

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Abstract
Aim: In this study, we aimed to evaluate the immediate and early period (30 days) complications in patients with percutaneous suprapubic cystostomy catheters (PSCC) inserted with two different techniques and investigate which technique is more reliable.
Materials and Methods: The data of 50 patients with PSCC inserted between June 2016 and June 2020 were retrospectively analyzed. The patients were divided into two groups as Conventional (Group 1: 30 patients) and Ultrasonography (USG)-assisted (Group 2: 20 patients) PSCC insertion. The demographic data, indications, procedure technique, immediate and early period complications and final results of all patients were analyzed.
Results: The mean age of the patients was calculated as 69.3 ± 17.8 years. The male: female ratio was 48:2. The most common indication of PSCC insertion was determined as urethral stricture (n: 23, 46%). The complication rate of all patients was calculated as 34% (immediate: 14%, early: 20%). The most common immediate complication was hematuria, while the most common early complication was urinary tract infection. No major complications or bowel injuries were observed in the patients. Catheter revision was performed in two patients in Group 1. In the early period, the number of complications was statistically significantly lower in Group 2.
Discussion: Regardless of the technique, PSCC insertion is an effective and reliable method. The use of the USG-assisted technique should be preferred, where possible, to reduce complications.

Keywords
Cystostomy; Urethral stricture; BPH, Prostatectomy; Complication

DOI: 10.4328/ACAM.20366 Received: 2020-10-06 Accepted: 2020-10-22 Published Online: 2020-10-26 Printed: 2021-01-01 Ann Clin Anal Med 2021;12(1):15-20
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Introduction

Percutaneous suprapubic cystostomy is a commonly applied procedure for urinary tract drainage in patients with unsuccessful urethral catheterization or requiring long-term catheterization [1, 2].

Suprapubic drainage of the bladder was firstly described in 1556 [2]. Although there are many techniques regarding percutaneous suprapubic cystostomy catheter (PSCC) insertion, the conventional method applied using direct blind access is widely used today. Ultrasonography (USG)-assisted technique enables simultaneous monitoring and insertion of the catheter and also provides information about adjacent organs and pathologies [3].

Like all minimally invasive procedures, there are some risks of PSCC insertion. Early and late complications have been reported [4]. In the literature, there are a limited number of studies comparing conventional and USG-assisted technique, and which of these two techniques is superior has not been clearly demonstrated [5, 6].

The primary objective of this study was to determine the reliability of the procedure and evaluate immediate and early complications in patients with PSCC insertion with two different techniques.

Material and Methods

Fifty patients with PSCC insertion between June 2016 and June 2020 were included in the study. The data of the patients were analyzed retrospectively. The patients were divided into two groups as Conventional (Group 1: 30 patients) and USG-assisted (Group 2: 20 patients) PSCC insertion. Patients, who were under 18 years of age and had incomplete data and contraindicated PSCC insertion, were excluded from the study. Contraindications of PSCC insertion are as follows: a) the presence and history of bladder tumor; b) bleeding diathesis disorders; c) skin infection in the suprapubic area. Age, gender, indication of PSCC insertion, technique, immediate and early complications of the patients were recorded. Complications were evaluated as immediate complications and complications developing within the first 30 days (early).

The primary objective of the study was to evaluate the reliability, immediate and early complications of two different techniques in patients with PSCC insertion. This study was carried out in accordance with the ethical principles of the Declaration of Helsinki.

Technique

In both techniques, the suprapubic area was sterilized with a 5% betadaine solution in the supine position and covered with a perforated sterile towel. Cutaneous and subcutaneous local anesthesia was applied with 20 mL of 0.25% bupivacaine.

Conventional PSCC Insertion

After the palpation of the pubic symphysis, the point approximately 2-4 cm above it (practically above 2 fingers) was determined as the puncture point. Globe vesicale was confirmed by bladder palpation and percussion. An approximately 2-3 cm transverse incision was performed with a scalpel numbered 11 to the puncture point determined from the midline. The PSCC was kept stable in the palm of the right hand and pushed forward from the skin to the bladder by bending and pushing downward, towards the pelvis, providing a controlled pressure. After the PSCC incision into the bladder was confirmed by the urine flow, the catheter was pushed 5-10 cm into the bladder and after the trocar removal, the balloon was inflated with 10 cc 0.9% isotonic to keep the catheter in the bladder. The PSCC was fixed to the skin using silk suture 2-0.

USG-Assisted PSCC Insertion

After the palpation of the pubic symphysis, the point approximately 2-4 cm above it (practically above 2 fingers) was determined as the puncture point. The bladder was scanned in the transverse and sagittal planes using USG. After the incision, while the PSCC was pushed forward from the skin to the bladder, continuous imaging of the bladder and the trocar of the PSCC were performed simultaneously. Before the puncture site was marked, the intestinal rings intervening between the bladder and the abdominal wall, and tumoral structures within the bladder were excluded. After the PSCC entered the bladder lumen, the catheter was pushed 5-10 cm, and after removing the trocar, the balloon was inflated with 10 cc 0.9% isotonic to keep the catheter in the bladder. The position of the inflated balloon was confirmed by the appearance of a smooth, round and echogenic structure in the bladder lumen. The PSCC was fixed to the skin using silk suture 2-0.

Statistical Analysis

Categorical data were presented as numbers and percentages. Data for continuous variables were presented as mean and standard deviation. The normality of the distribution of the continuous variables was evaluated using the Shapiro-Wilk test. The means of the two groups showing normal distribution were compared using the student t-test. The frequencies of the categorical variables were compared using the Pearson Chi-square test or Fisher's exact test. Sta-tistical significance was accepted as $p<0.05$. Statistical analysis was performed using Statistical Package of Social Sciences version 21 (IBM SPSS Statistics; IBM Corp., Ar-monk, NY).

Results

The mean age of the patients was 69.3 ± 17.8 years, while the male: female ratio was 48: 2. Emergency department was determined as the most common place of admission. In 23 patients (46%), urethral stricture was determined as the most common factor responsible for the etiology of PSCC insertion. Fourteen patients (28%) had a history of anticoagulant-antiaggregant use. Thirty-four patients (68%) had a history of previous surgery. In 11 patients (22%), the most common previous surgery was transurethral resection of the prostate (TUR-P). The most commonly performed surgery in the final treatment was internal urethrotomy (n: 21, 42%). The demographic data and clinical characteristics of the patients are presented in Table 1.

No statistically significant difference was observed between the groups in terms of demographic and clinical characteristics. While there was no difference between Group 1 and Group 2 in terms of immediate complications (p: 0.100), a statistically significant difference was observed in terms of early complications (p: 0.030). The most common immediate complication was determined as hematuria, while the early complication was urinary tract infection (Table 2).

Table 1. Baseline characteristics and demographics features

Patient no, n	50
Age	
Mean ± SD	69.3 ± 17.8
Median (range)	71 (23-99)
Gender, n (%)	
Male	48 (96)
Female	2 (4)
Technique, n (%)	
Conventionel	30 (60)
USG - assited	20 (40)
Place of Admisson/Application, n (%)	
Emergency Department	43 (86)
Urology Outpatient Clinic	5 (10)
Intensive Care Unit	2 (4)
Etiology, n (%)	
Urethral stricture	23 (46)
Benign prostatic hyperplasia	14 (28)
Bladder neck stenosis	6 (12)
Urethral injury	5 (10)
Urethral stone	2 (4)
Use of anticoagulant /antiaggregant, n (%)	
Yes	14 (28)
None	36 (72)
Previous surgery, n (%)	
None	16 (32)
TUR-P	11 (22)
Open simple prostatectomy	5 (10)
Internal urethrotomy	5 (10)
URS	3 (6)
Radical prostatectomy	3 (6)
Cardiac surgery	3 (6)
Other	3 (6)
Urethral injury repair	1 (2)
Immediate complication, n (%)	
None	43 (86)
Yes	7 (14)
Early complication, n (%)	
None	40 (80)
Yes	10 (20)
Treatment, n (%)	
Internal uretrotomy	21 (42)
Follow-up with PSSC	11 (22)
TUR-P	7 (14)
Cystoscopy-catheterization	4 (8)
Bladder neck resection	3 (6)
Urethroplasty	2 (4)
Open simple prostatectomy	1 (2)
Cystolithotripsy	1 (2)

USG: Ultrasonography, TUR-P: Transurethral resection of the prostate, URS: Ureterorenoscopy, PSSC: Percutaneous suprapubic cystostomy catheter

Table 2. Comparison of patients' characteristics in Group 1 and Group 2

	Group 1	Group 2	P- value
Number of patients	30	20	
Average age ± SD, years	72.4 ± 13.8	94.8 ± 22.1	0.280 ¥
Place of Admission/Application, n (%)			
Emergency Department	26 (86.7)	17 (85)	
Urology Outpatient Clinic	3 (10)	2 (10)	1.000 &
Intensive Care Unit	1 (3.3)	1 (5)	
Etiology, n (%)			
Urethral stricture	13 (43.3)	10 (50)	
Benign prostatic hyperplasia	9 (30)	5 (25)	
Bladder neck stenosis	2 (6.7)	4 (20)	0.491 &
Urethral injury	4 (13.3)	1 (5)	
Urethral stone	2 (6.7)	0 (0)	
Use of anticoagulant/antiaggregant, n (%)			
Yes	6 (20)	8 (40)	0.123 #
None	24 (80)	12 (60)	
Previous surgery, n (%)			
None	12 (40)	4 (20)	
TUR-P	9 (30)	2 (10)	
Open simple prostatectomy	2 (6.7)	3 (15)	
Internal urethrotomy	1 (3.3)	4 (20)	
URS	1 (3.3)	2 (10)	0.056 &
Radical prostatectomy	2 (6.7)	1 (5)	
Cardiac surgery	2 (6.7)	1 (5)	
Other	0	3 (15)	
Urethral injury repair	1 (3.3)	0	
Immediate complication, n (%)			
Hematuria / Revision	3/2 (25)	2/0 (6.7)	0.100 &
Early complication, n (%)			
Infection / Blockage	4/3 (35)	3/0 (10)	0.030 #

SD, standart deviation
*Indipendent T- test
#Pearson Chi-Square
¥ Mann-Whitney U test
& Fisher'sExact Test
USG: Ultrasonography, TUR-P: Transurethral resection of the prostate, URS: Ureterorenoscopy, PSSC: Percutaneous suprapubic cystostomy catheter

Table 3. Urine culture results - Urinary pathogens

Escherichia coli	n:3
Pseudomonas	n:2
Pseudomonas aeruginosa	
Pseudomonas putida	
Klebsiella pneumonia	n:1
Enterococcus faecalis	n:1

Hematuria regressed with hydration in 3 patients with immediate hematuria. Hematoma was evacuated with catheter irrigation and traction in 2 patients who developed immediate hematoglobe, and hematuria regressed. Asymptomatically, reproduction was detected in the final preoperative urine culture in 7 patients. The most common bacteria were Escherichia coli (E. coli) in 3 patients, pseudomonas group in 2 patients, klebsiella pneumoniae in 1 patient and enterococcus faecalis in 1 patient, respectively. All patients were treated with antibiotics according to their urine culture results. Urine culture results are presented in Table 3. In the patients with catheter blockage, urine output was enabled by irrigation of the catheter

and increasing the patient's hydration. Catheter revision was performed in 2 patients in Group 1 due to malpositioned catheter. On computed tomography (CT) of the lower abdomen of the patient who initially had hematuria in the urine after catheter insertion and then did not have effective urine drainage, it was observed that the catheter could not completely pass the anterior wall of the bladder (Figure 1). In another patient, the catheter was observed to be in the retzius space in the USG performed due to the lack of effective drainage of the catheter. Catheter revision was performed in conjunction with USG in both patients. No major complications or bowel injuries were observed in the patients. All complications were managed

Figure 1. Appearance of globe vesicale and displaced catheter. (a) coronal section, (b) saggital section.

conservatively.

Discussion

Causes of urinary retention include benign prostatic hyperplasia (BPH), urethral stricture, prostate cancer, clot retention, stone and neurological bladder [7]. In two studies reported in the literature, urethral stricture and BPH were determined as the most common causes of urinary retention in patients with PSCC, respectively, and there was only one female patient in both study populations [5, 8]. Similarly, the most common etiological factor in our series was urethral stricture, and the second was BPH. Furthermore, we had two female patients with urethral stricture in our series.

Although PSCC insertion is considered a simple procedure, many complications have been reported in the literature regardless of the technique. In their series, Cronin et al. detected that 42 patients had minor complications by 7.2%, and 538 patients had major complications by 0.17% [9]. In another study, which retrospectively analyzed 157 patients, the complication rate was 10% with a 2.7% incidence of intestinal perforation [10]. In the series of Ahluwalia et al., the general complication rate was reported as 29% (intraoperative 10%, 19% for 30 days) [11]. In accordance with the literature, the immediate complication rate was found to be 14%, while this rate was 20% in the early period in our series. Although our complication rate was high, all these complications were removed with minor and conservative treatments. No major complications were observed in our patients.

The most serious complication is peritoneum and bowel injury since the anterior side of the bladder is covered with peritoneum [12]. Gastrointestinal system complications due to adherences may increase in patients who have previously undergone abdominal surgery and received radiation. Open simple or radical prostatectomy performed due to BPH or prostate cancer in urological patients is usually performed retropubically, and the insertion of PSCC that may develop after bladder neck or urethral stricture can be performed relatively more safely in these patients. However, due to the deterioration of the retzius space and the displacement of the intestines in robotic and laparoscopic surgery, which has increased in recent years, attention should be paid to preventing possible complications during this procedure. It is important to use USG for a more reliable procedure especially in patients who have undergone abdominal surgery. A study evaluating the intestinal interposition in PSCC tract to avoid gastrointestinal complications states that it is important to be careful when placing PSCC to prevent possible bowel damage in patients who are obese, who have undergone a previous radical pelvic operation, or who have a short distance (<11 cm) between the upper edge of the symphysis pubis and the umblicus [13]. In our series, 3 patients had a history of prostate cancer surgery (laparoscopic radical prostatectomy in 1 patient, open radical prostatectomy in 2 patients), open simple prostatectomy in 5 patients and abdominal surgery in 2 patients. Intestinal complications were not observed in any patient.

Another complication is the initial failure or incorrect insertion of PSCC. The location of the catheter must be confirmed after the procedure. In the future, it may cause complications such as ileus and infection [14]. Studies published in the literature have reported catheter displacements at a rate of 7.6%-23% [15 - 17]. Hasan AT et al. reported a history of previous abdominal surgery in all failed operations and a history of inability to insert the catheter into the bladder due to fibrous scar [17]. In their retrospective large series consisting of 219 patients, Ahluwalia et al. stated the rate of PSCC malposition as 3%. It was observed that the majority of the cases included patients with neurogenic bladder [11]. In the series of Chandra et al., catheter malposition was seen in 5 (16.7%) of 30 patients with conventional PSCC insertion, and it was not observed in any patients with USG-assisted PSCC insertion [5]. In our series, catheter revision was performed in two patients due to the lack of effective urinary drainage. These two patients were in the group with conventional PSCC. While one patient had severe obesity, the other had a history of previous prostate surgery. We think that USG-assisted technique should be preferred to prevent catheter displacement, especially in patients with obesity, previous abdominal surgery and small bladder capacity.

Catheter blockage and urine leakage around the catheter is the most common situation that urges the patient to apply to the emergency department again. Insufficient fluid intake and encrustation are the main causes of blockage. Kinking of the catheter bag and tenesmus findings due to irritation may cause urinary leakage [18]. In a series reported by MacDiarmid et al., catheter blockage was reported in 36% [19] and 38% was reported by Barnes et al. [15]. In the series of A.T. Hasan et al., leakage around the catheter was reported in 28.5% of the patients. In the series of Sethia et al., leakage was found in 9.4% of the patients [20]. Catheter blockage was observed in 3 patients in our series.

In their study, which presented the results of urinary tract infection and urine culture after PSCC, they reported that

the urine culture positivity increased as the catheter duration increased. In parallel with our study, E.coli was found to be the most common microorganism [20].

Insertion of PSCC in patients receiving anticoagulant and/or antiaggregant poses a risk due to hematuria, hematoma and hematoglobe. The use of antiaggregant and anticoagulant is common, especially in the elderly group undergoing cardiac surgery. In these patients, it is important to place a percutaneous suprapubic catheter in a single attempt with minimal trauma when possible. One study reported hematuria in 25% of patients within the first 24 hours after the procedure [17]. In our series, 14 patients were using antiaggregant and anticoagulant. Despite the fact that hematuria was observed in 5 patients at once, hematoglobe developed in 2 patients. The patient with hematoglobe was treated conservatively by inflating the catheter balloon with traction and bladder irrigation. Hematuria in other patients was considered ex-vacou hematuria and regressed with hydration.

The techniques of percutaneous suprapubic cystostomy catheter insertion can be performed with direct trocar-guided blind drilling through the Seldinger technique, cystoscopy, fluoroscopy and ultrasound assisted [21]. Aguilera et al. analyzed 17 consecutive patients in a 2-year period in their study evaluating the reliability and efficiency of USG-assisted suprapubic cystostomy catheter insertion in the emergency service. No complication was detected in any patient in the immediate and 2-week follow-up [3]. In another study, it was reported that the USG-assisted technique was simple, safe, effective and associated with minimal complications [8]. In two studies comparing direct blind and USG-assisted techniques in the literature, the ultrasonography procedure was found to be safer, which is consistent with our study [5, 6]. In our study, no difference was found between the two techniques in the groups except for early complications. Considering that early complications are those that can be corrected with conservative treatments such as infection and hematuria, it can be stated that both techniques are safe.

Another advantage of the USG-assisted technique is that it reveals the possible presence of a tumor in the bladder, which is a serious and dramatic complication, while inserting a percutaneous suprapubic cystostomy catheter. In this case, the procedure should not be performed due to the risk of tumor seeding into the skin. In patients with a history of hematuria or previous endoscopic interventions, the history should be examined, and the bladder should be visualized with USG. Moreover, the USG-assisted technique may be useful in complicated cases with displacement of the bladder and possible hematoma, especially in patients who require percutaneous suprapubic cystostomy catheter insertion after trauma.

The PSCC insertion is a procedure that has long been successfully and safely used in urological practice. Apart from the urology discipline, another discipline that applies this procedure is the emergency medicine clinic. In the initial phase of PSCC insertion, the use of USG-assisted technique may be helpful in reducing complications, especially in patients who have bleeding diathesis, do not have sufficient bladder distention, are obese and have a previous abdominal surgery particularly pelvic surgery and have low neurogenic bladder capacity [11,13].

The main limitation of our study is the small number of patients and its retrospective design. Another limitation is the lack of randomization between the groups.

In conclusion, PSCC insertion is a technical, independent, efficient and reliable method. During PSCC insertion, USG-assisted technique should be preferred to avoid technical complications whenever possible.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: *None*

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:
Yurdagul Cetin Seker, Fatih Akkas, Muammer Bozkurt, Mehmet Ezer, Yavuz Tarik Atik, Kamil Gokhan Seker.Reliability of percutaneous suprapubic cystostomy catheter insertion and analysis of complications. Ann Clin Anal Med 2021;12(1):15-20